1. SUMMARY INFORMATION PAGE

Project title: Seattle and Tacoma Air Toxics Trends in Sources and Risk

Applicant information: Puget Sound Clean Air Agency, 1904 3rd Ave, Suite 105, Seattle, WA 98101
Contact person: Adam Petrusky, adamp@pscleanair.gov, 206-689-4081, fax 206-343-7522
Funding requested: $657,840
Total Project Cost: $772,229, including an Agency cost-share of $114,389 in-kind
Project period: Expected to start in October of 2020 and last for 36 months (September of 2023)
DUNS number: 3634223740000

Abstract

In this proposal, we seek to identify trends in air toxics for the Puget Sound region. With many different emission source changes over the years, an explosion of population growth in our region, and emerging concerns like ethylene oxide and an increase in wildfire smoke emissions, it is challenging to focus our emissions reduction efforts without more detailed air toxics data.

We aim to better understand changes in air toxics concentrations from diesel exhaust sources, wood smoke, ethylene oxide, and industrial source metal emissions since our last detailed study of this area ten years ago.[1] We will produce new estimates of potential cancer risk and compare these to past values and to the National Air Toxics Assessment. Using factor analysis on both historical data and "freshly" sampled data, we will look at changes in emissions sources, trends, and associated risks, adjusting for weather where possible. We will use the results of this analysis to deepen our understanding of emission inventories for our region, either helping to explain the results or potentially identifying gaps where emission inventories may have mischaracterized sources.

We will engage with communities to help establish where and what air toxics we will analyze in a community-directed sampling campaign. We also propose to do an environmental justice analysis of air toxics risks over time by geography to see how gaps in equity have changed in these communities.

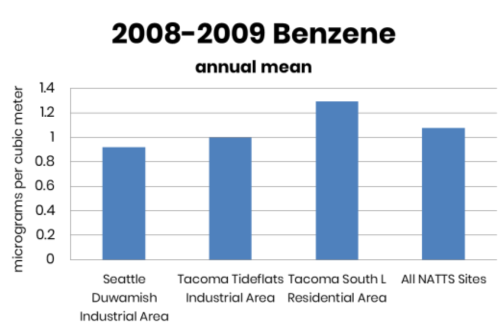
2. PROJECT SUMMARY/APPROACH

Background

As emission sources have changed over time, the Puget Sound region is left with many unknowns on how to characterize air toxics risk. Three factors make this a critical region to study: 1) an updated unit risk factor for ethylene oxide, 2) the seventh largest population growth in the country over the past ten years,[2] and 3) recent changes in fleets of ships, trucks, cars, trains, industrial activities, and wood stove home heating have left open questions on how to best focus our emission reductions.

Past air toxics studies[1,3] in Seattle and Tacoma showed that we are a unique area in the country. In Tacoma, we saw higher levels of benzene in the residential area on an annual average just due to the wintertime wood smoke levels, than both of the large port/industrial areas of Tacoma and Seattle (Figure 1). This area was nonattainment for the 2006 $PM_{2.5}$ NAAQS. Since then, we adopted aggressive measures to reduce wood smoke emissions there, including banning and offering incentives to recycle older uncertified wood stoves and enhanced burn ban enforcement. With improvement in emissions reductions in shipping with the Emission Control Area and newer truck and other diesel engines, we expect improvements in the port/industrial areas as well. This study will help us determine how to best focus emission reductions in Tacoma.

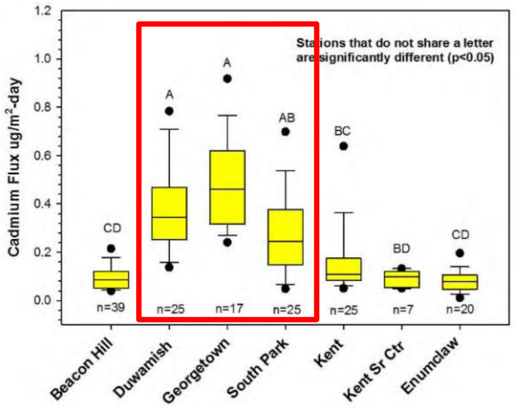
Figure 1. Benzene levels from our past air toxics study in Tacoma showing highest levels in a wood smoke impacted neighborhood



Our prior studies[1,3] have shown that the last two EPA National Air Toxics Assessment (NATA) models have performed poorly in our region, due to complex topography and meteorology. Air monitoring remains the best method to estimate local air toxics risks and extrapolate them to a wider region. Recently, the Seattle National Air Toxics Trends Stations

(NATTS) site has shown lower ethylene oxide levels compared to other studied sites. Doing further ethylene oxide analysis in our region will help answer: Is our entire region at a “background” level risk for ethylene oxide, despite being in a large urban area with numerous small sources, or does the sampling at the NATTS site underrepresent the risk from ethylene oxide?

Figure 2. Example of the three Seattle Duwamish Valley sites with higher metal flux (Duwamish, Georgetown, South Park). Source: King County



Both the Seattle Duwamish Valley (Figure 2) and Tacoma Tideflats industrial areas have been shown to have high levels of metals from atmospheric deposition compared to other areas.[4,5] A metals-in-moss sampling study led by the US Forest Service in the Seattle industrial area will be released soon, which may bring questions about what potential health risk exists if pollutant gradients are found. A similar study was completed in Portland, OR a few years ago that eventually led to the identification of an art glass maker releasing large amounts of arsenic and cadmium.[6] PM_{10} metals sampling would be helpful to provide more definitive ambient concentrations and corresponding potential health risk.

In our last air toxics study in Seattle,[3] we found two types of diesel emissions from highway traffic, a “fresh” near-road diesel factor and evidence of a “background” diesel factor. To do this, we used novel approaches with positive matrix factorization (PMF) using air toxics data. Learning how the emissions are different at the near-road site in Tacoma (at the S 36th Street site) would be valuable and help us quantify the relative importance of background diesel emissions and the different vehicle fleets.

We are actively engaging with communities that face environmental and societal barriers to clean air. In our engagement with these communities, termed “focus communities”,[7] we have used monitoring tools such as our air sensor lending library, community science training, community-directed air toxics, and other emissions sampling. In this study, we will build on our experience, and continue to use community-directed sampling with our community partners.

Sampling approach

This study will help characterize the impact of air toxics in environmentally burdened communities in Seattle and Tacoma. We will focus on key air toxics with the highest potential health risks in our region (benzene, 1,3-butadiene, carbon tetrachloride, acrolein, formaldehyde, and acetaldehyde), as well as measuring surrogates for diesel and wood smoke particulate matter (black carbon and UV channels, and PAHs).[8] We will also monitor for ethylene oxide, which with an updated unit risk factor, may shift to become the air toxic with the highest risk. We will also look more in depth at industrial atmospheric deposition by monitoring for PM_{10} metals, and better understand the sources of emissions using factor analysis by sampling PAHs.

We will measure at five sites for one year, leverage data from a sixth site that is part of the NATTS program, and have additional community-led sampling (Table 1). The sites will be located in industrial, near-road, and wood smoke affected areas. The latest air toxics sampling in most of these communities took place in 2008-2009 when the Puget Sound Clean Air Agency (PSCAA) conducted an EPA funded air toxics monitoring campaign (EPA Grant XA96069801).[1Error! Bookmark not defined.] PSCAA also gathered air toxics data during 2016-2017 in the Chinatown-International District (EPA Grant XA01J10401).[3] We plan to compare our results to these studies to see how air toxics concentrations and risks have changed over time. For a detailed project timeline please see Table 2 in the Environmental Results section.

The communities that these sites cover are within the top 5% of most heavily-impacted areas in our jurisdiction, according to our environmental justice map, the Community Air Tool, which scores each block group based on air pollution, health impacts, and demographics. Specifically, we have been working with communities in Chinatown-International District, Duwamish Valley, and Lakewood to reduce air pollution exposure and environmental inequity (Figure 3). Our community partners will take the lead on defining air toxics of concern for the community-led sampling campaign. We will work closely with them during the analysis of the community sampling data and work together to share the results of the project with the broader community.

Instruments and Sites

Table 1. Proposed sampling sites, duration, and frequency

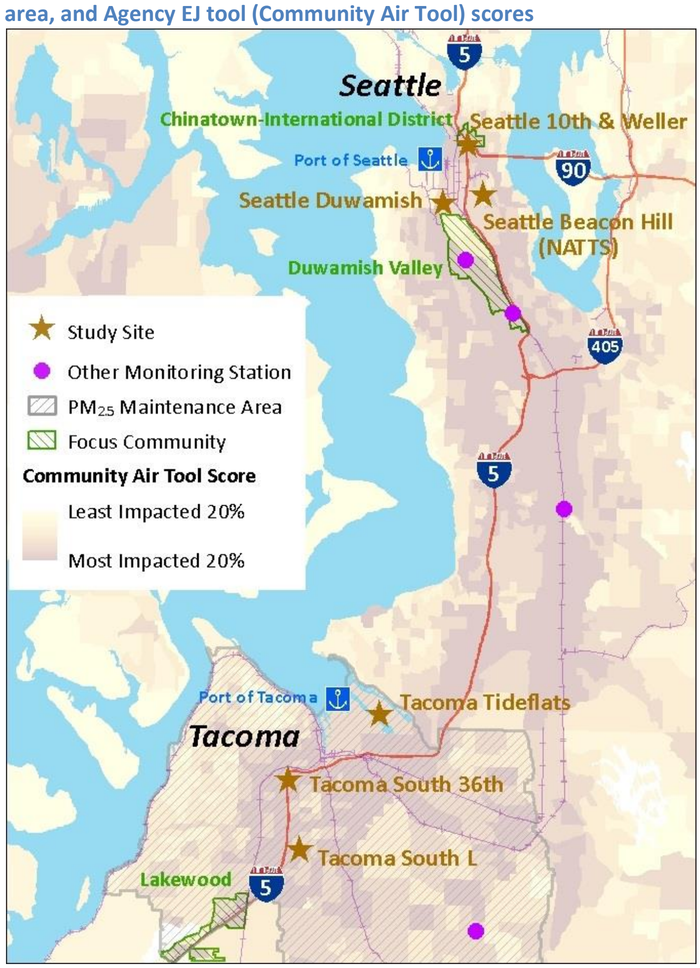
Sites	Measured parameters (from this grant and *leveraged*[a])	Monitoring Frequency
Tacoma S. L Street (residential)	Select VOCs,[b] select aldehydes,[c] *BC, $PM_{2.5}$, $PM_{2.5}$ speciation, temperature, winds*	One 24-hr sample every six days for one year
Tacoma Tideflats (industrial)	Select VOCs,[b] select aldehydes,[c] PM_{10} metals, *BC, $PM_{2.5}$, $PM_{2.5}$ speciation, temperature, winds*	One 24-hr sample every six days for one year
Tacoma S. 36th street (near-road)	Select VOCs,[b] select aldehydes,[c] *NO_2, NO_x, NO, CO, BC, $PM_{2.5}$, planned $PM_{2.5}$ speciation, temperature, winds, traffic counts*	One 24-hr sample every six days for one year
Seattle 10th and Weller (near-road)	Select VOCs,[b] select aldehydes,[c] *NO_2, NO_x, NO, CO, BC, $PM_{2.5}$, $PM_{2.5}$ speciation, temperature, winds, traffic counts*	One 24-hr sample every six days for one year
Seattle Duwamish (industrial)	Select VOCs,[b] select aldehydes,[c] PM_{10} metals, PAHs, *BC (including other 6 channels), $PM_{2.5}$, $PM_{2.5}$ speciation, temperature, winds*	One 24-hr sample every six days for one year
Seattle Beacon Hill (leveraged NATTS site)	*Full suite of VOCs, PAHs, aldehydes, PM_{10} metals, NO_2, NO_x, NO, SO_2, CO, BC, $PM_{2.5}$, $PM_{2.5}$ speciation, temperature, winds*	One 24-hr sample every six days for one year
Community-directed sites	Air toxics to be determined by the community, *$PM_{2.5}$ sensors*	Up to 20 samples

[a] The Tacoma S 36th St, Seattle 10th and Weller, and Seattle Beacon Hill monitoring sites are operated by the Washington Department of Ecology, which has agreed to grant us access and support to deliver this grant project if awarded.

[b] Benzene; 1,3 butadiene; carbon tetrachloride; tetrachloroethylene; ethylbenzene; acrolein; ethylene oxide

[c] Formaldehyde and acetaldehyde

Figure 3. Study sites, focus community locations, $PM_{2.5}$ maintenance area, and Agency EJ tool (Community Air Tool) scores



a. Two near-road sites

To compare the near-road sites, we will have sampling for select VOCs and aldehydes. This will help us in comparing the two near-road sites that have differing wind and traffic patterns. Both sites are located within 50 meters of Interstate 5, in Seattle on the corner of 10th Ave and Weller St, and Tacoma S. 36th Street, adjacent to Jennie Reed Elementary School. We will leverage current and planned $PM_{2.5}$ speciation data to estimate diesel concentration.

b. Two industrial-port sites

The Puget Sound region has two port and industrial valleys, one in Tacoma and Seattle. We propose monitoring for metals, in addition to the other air toxics, as the community has raised concerns over metal deposition. We also propose adding PAHs to help better characterize the aerosols with factor analysis. We will leverage speciated trends network (STN) speciation data currently being collected at these sites. We have air monitoring records for the Seattle Duwamish and Tacoma Tideflats going back to the early 1970's.

c. One former nonattainment residential wood smoke impacted site

The Tacoma South L Street site historically had $PM_{2.5}$ concentrations that violated EPA's 2006 Federal Daily Standard. Since then, we have made strides to reduce wood smoke in the area, by banning uncertified stoves, stove changeout programs, and enhancing enforcement. The site is representative of a "maximum concentration urban wood smoke" site in our 4-county jurisdiction.

d. Leveraged NATTS site

A sixth site, the NATTS site at Seattle-Beacon Hill, is in a residential neighborhood a few miles from the Seattle Duwamish and 10th and Weller sites, and will continue to operate without making use of funding from this grant. This site has a full suite of air toxics monitors including canister (VOC) EPA Method TO-15, tube TO-11A (aldehydes), PM_{10} Hi-Vol IO-3 (metals), and PUF (PAH) TO-13A samplers. Leveraged monitoring will meet NATTS quality assurance requirements for speciation samplers (including the URG3000N carbon sampler) and FEM approved NO_2, CO, SO_2, and $PM_{2.5}$ monitors. We will use Beacon Hill data in our analysis and conclusions as appropriate.

e. Community-directed sampling

In addition to the fixed sites, we will include at least six days of community-directed air toxics sampling at three locations in the Duwamish Valley. This community does not have recent air toxics data and community groups in the Duwamish Valley have expressed interest in participating in air toxics sampling. The community-directed sampling will allow the community to identify locations of interest, actively participate in collecting samples, and learn about air toxics concentrations at those locations. We will sample on the same days that fixed sites are operating to provide greater spatial gradient information. In this portion of the monitoring campaign, we will leverage continuing partnerships with the *Duwamish Community Action Program for Clean Air*, a collaborative of air quality stakeholders, that already has community networks and avenues for input to direct this portion of the sampling. Some of the initial interest has been in metal deposition (possibly PM_{10} metals and hexavalent chromium).

In addition to the Duwamish Valley targeted sampling, we will conduct outreach and educational $PM_{2.5}$ sensor sampling at sites of community interest in the Chinatown-International District and Lakewood focus communities using low-cost sampling methods to complement fixed site data collection.

Data Analysis

The data analysis will focus on meeting the grant's Output and Outcome objectives, and addressing the main scientific questions.

The specific scientific questions to be addressed are:

1. Has average potential cancer risk from air toxics in Seattle and Tacoma changed since 2010?
2. If a change in concentrations is observed, can it be explained by meteorology rather than emissions changes?
3. Can patterns be detected in the data that suggest emission sources, activities, categories, or events? (e.g. transportation, industrial sectors, residential wood burning, fireworks, etc)
4. Has there been any change in the distribution of air pollutants and risk across the focus communities?
5. How do our measurements and analysis compare to other available measurements and modeling (NATA and NATTS)?
6. What additional tools or analysis can be developed to improve our ability to identify pollution sources, assess risk, develop plans to reduce future risk, and address community concerns?

We will evaluate the data in a multi-step process beginning with quality checks; progressing to basic descriptive statistics, trends and correlations; and ultimately to complex patterns reflecting various sources, meteorological phenomena, risk, and environmental justice aspects.

As data are being collected, and before beginning in-depth analysis, we will conduct a full quality assurance assessment. This entails checking for data completeness, potential interferences, outliers, trends, internal consistency, and any trends and diurnal patterns. Additional review will help in the analysis, including identifying the best statistical techniques, e.g. how to handle non-detects (if data are significantly left censored) and any adjustments that might be needed for non-normal distributions, or missing values.

We will then calculate descriptive statistics such as averages, medians, percentiles, and distributions for all the measured air toxics.

The more complex analyses include, and will generally progress as follows:

1) *Assess the potential impact of meteorology on the observed trends and patterns*

We will use available meteorological data (wind speed, direction, temperature, precipitation, etc) to assess the potential impact of meteorological factors. The analysis will include, at a minimum, looking at distributions of wind speed, direction, and temperature, to identify potential confounding influences on long-term trends.

2) *Estimate potential cancer risks for fixed sites*

Based on statistical summaries described above, we will calculate potential cancer risk using the Washington State Acceptable Source Impact Levels unit risk factors.[9] Based on these estimates, we will provide a ranking of air toxics, which will help us quantify the health hazards attributed to air toxics.

3) *Compare air toxics concentrations and risks for Seattle and Tacoma from the 2010 and 2016 studies*

We will use all comparable data and risk calculations to compare to the 2010 Study of Air Toxics in Tacoma and Seattle[1], and the 2016 study in Seattle's Chinatown-International District.[3] A primary question for this study is: how has air pollution and toxic risk changed over the last 10 years? We anticipate being able to include comparisons for diesel and wood smoke estimates at the Tacoma Alexander, Seattle Duwamish, and Beacon Hill sites.

4) *Compare air toxics concentrations and risks to the NATTS network*

We will aggregate three years of NATTS data across the country, average the results, and apply the same unit risk factors to evaluate and compare risk across the country. A key comparison will be with the nearby Seattle Beacon Hill NATTS, about 1.6 miles to the east of the Duwamish site. The Beacon Hill site is at a substantially higher elevation (+ 100 m), and further away from major sources in the Duwamish Valley, providing a good regional background.

5) *Compare air toxics concentrations to nearby 2017 National Air Toxics Assessment (NATA) model estimates*

We will compare our results to the 2017 National Air Toxics Assessment model. The analysis will include mapping (ArcGIS or similar) and descriptive statistics for the census tracts containing or near to sampling sites, and in the focus community.

6) *Identify and quantify air toxics sources through source apportionment*

We will use both data collected specifically for this project and leveraged data from the existing, collocated sites. The existing instruments and data collected vary across all of the fixed sites. They include aethelometers (UV to IR absorption, with 2 or 7-channels), fine particulate matter (BAM and/or nephelometer), CO, NOx, and meteorological parameters (wind speed, wind direction, temperature, barometric pressure, relative humidity).

We will use all of the available data in a factor analysis (e.g. PMF or Chemical Mass Balance, CMB) to identify and quantify air toxics sources such as transportation, industrial facilities, or other sectors (e.g. residential wood burning). The factor analysis will examine monitored concentrations of air toxics, metals, PAHs, black carbon, fine particles, carbon monoxide, nitric oxide, and may include supplementary data such as traffic counts, temperatures, wind speeds, and humidity. As they are available, we will also include organic carbon, elemental carbon, and many other particle fractions from any collocated speciation data provided by the Washington State Department of Ecology. We will attempt to estimate concentrations of diesel particulate matter, an important mobile source air toxic, so that we may include its estimated levels and risk (at least qualitatively) as we communicate results.

7) *Extrapolate risks from the fixed sites to quantify potentially exposed populations and their potential risk*

If a chemical marker or PMF pattern appears to provide relatively consistent ratios to the toxics that drive most of the risk (e.g. benzene, 1,3-butadiene, formaldehyde, ethylene oxide), we will extrapolate the air toxics levels beyond the fixed sites to the surrounding census block groups based on estimated source emissions, with associated uncertainties indicated prominently. We will investigate ratios of the marker/pattern to specific air toxics, as well as to criteria pollutants.

8) *Additional multivariate geospatial analysis based on the concerns of the focus communities*

Based on the concerns expressed by the focus communities, we will conduct additional analyses. The analyses could include, or be specific to, additional measurements or data requested by the communities but not specified beforehand. It could also include using existing data to produce a high-resolution gradient or map of pollutants or risk for nearby industrial areas, the Port of Tacoma or Seattle, or gradients from the nearby roads and vehicles, or other specific concerns that the communities identify.

PSCAA will take the lead on this grant and leverage our existing instruments and monitoring sites as well as a number operated by the Washington State Department of Ecology. We have done similar work before including a recent air toxics study in the Chinatown-International District (EPA Grant XA01J10401). We have a track record of completing grants on time and on budget. Our staff have many years of experience in air monitoring, data analysis, and community outreach. A number of the staff who participated in the successful Chinatown-International District grant will work on this project as well.

3. ENVIRONMENTAL RESULTS – Outcomes, Outputs, and Performance Measures

Our proposed work will respond to EPA's goal "A Cleaner, Healthier Environment" by accurately measuring air toxics within disproportionally impacted communities that suffer from poor air quality in addition to substantial socio-economics challenges. With this additional dataset, we will assess risks and make sure "high air quality standards" are met.

Anticipated environmental **outputs** from the proposed work:

- Producing high quality HAP data, which will be made publically available via EPA's AQS database
- Identification and inventory of community-specific air toxic concentrations and cancer risk
- Evaluating the NATA model and NATTS data in our region
- Evaluating progress at reducing risk and exposure, and potentially setting benchmarks for further reductions
- Disseminate results via public meetings, blog posts, social media, presentations in schools and libraries to raise awareness and present key findings to focus communities
- A final report, which will include a summary with key findings for focus communities and policy makers as well as accurate data analysis and modeling to fulfill research objectives

Anticipated environmental **outcomes** from the proposed work:

1. *Short-term:*
- Increase community awareness on air quality issues
- Identify air toxics sources
- Improve assessment of air toxics exposure and risk

2. *Mid-term:*
- Help identify source types to prioritize
- Empower respective communities with the report results

3. *Long-term:*
- Increase data inventory for the Puget Sound region available for researchers, policy makers, general public
- Future priorities for source emission reductions are more accurately identified

Performance measurements:

- All monitoring activities will comply with SOPs and the QAPP
- Project manager will hold routine meetings with the project team to review the work and the project timeline
- Project manager will check budget balances with managers monthly and adjust as needed
- Communication with EPA's program manager will be maintained through quarterly progress reports and check-ins as needed

Table 2: Timeline of the proposed work for: monitoring/analysis (dark grey), community engagement (light grey) and reporting (black)

Timing:	*Year 1: 2020-2021*				*Year 2: 2021-2022*				*Year 3: 2022-2023*			
Milestones:	*Fall*	*Win.*	*Spr.*	*Sum.*	*Fall*	*Win.*	*Spr.*	*Sum.*	*Fall*	*Win.*	*Spr.*	*Sum.*
Community engagement												
Input from communities on project and timeline												
Finalize study design												

Generate QAPP, SOPs												
Setup contract with analytical laboratory												
Install monitors												
Progress reports to EPA												
Fixed-site sampling												
Community-led sampling												
Outreach events												
Data analysis												
Draft report												
Inform communities on findings												
Final report												
Final outreach events												
Community "next steps" plan												

4. PROGRAMMATIC CAPABILITY AND PAST PERFORMANCE

We have a proven track record of fulfilling past EPA grant work successfully and on time. We have a deep bench of staff skilled in environmental monitoring, air toxics data analysis, community engagement, and results reporting. We have agency policies that ensure and enable wise and appropriate use of federal grant funds, and our state auditor routinely audits our agency's use of federal grant funds, with no findings in recent years. Here are a few examples of recent Federal Assistance Agreements:

1) **Highway Air Toxics Impacts in the Chinatown-International District of Seattle, 2015-2018**
   Funding Agency: EPA, No: XA-01J10401
   Grant Totals: $580K; Grants Combined Total: $740K
   This project quantified levels of air toxics and identified key sources. We also partnered with community groups to translate study findings into action designed to limit exposure. We exceeded our $160K matching cost-share and completed the project well within timelines and budget including submitting the final technical report. Key agency staff from that project will participate in the project proposed herein, supplemented by new staff who bring additional relevant skills.
2) **School Bus Engine Replacement Grant, in progress**
   Funding Agency: EPA, No: DE-01J53801-0
   Grant Totals: $1.38M
   We are working with school districts in our jurisdiction to replace diesel school buses with low-NOx propane buses. This grant was awarded in 2018 to replace 22 buses, and we are on track to exceed this goal. The project manager is up-to-date on all project and status reports.
3) **Marine Engine Replacement Program, in progress**
   Funding Agency: EPA, No: DE-01J40801
   Grant Totals: $650K
   We were awarded this grant in 2017 to replace old marine engines with new Tier-3 or better ones. We have met the deliverable of replacing 18 engines from 8 vessels, reducing ambient air pollution and deposition of air toxics to sensitive waterways. The project manager is up-to-date on all project and status reports.
4) **Drayage Trucks Replacement and Clean Truck Training Grant**, **2016-2018**
   Funding Agency: EPA, No. DE-01J26001,
   Grant Totals: $800K
   This project scrapped and replaced 19 older drayage trucks with trucks that met EPA's 2010 emissions standards. To enhance the sustainability of the emission reductions, we used project funding to develop Clean Truck Training videos in seven languages for drivers and truck owners.

6. DETAILED BUDGET NARRATIVE

See form SF-424A sections A-F in this grant application package for more details. The following table contains the itemized costs related to each budget category.

Table 3. Itemized costs related to each budget category.

Budget Category and Detail	EPA Funding	Cost-Share
Personnel		
(1) Air Monitoring Lead @ $59.35/hr x 3.1 hr/wk x 130 wk		$23,800
(1) Air Resources Specialist @ $51.9/hr x 3.1 hr/wk x 130 wk		$21,018
(1) Environmental Justice Coordinator @ $42.8/hr x 2.6 hr/wk x 78 wk		$8,709
(1) Air Monitoring Specialist II - Special Project Coordinator @ $53.14/hr x 17.7 hr/wk x 156 wk	$146,956	
(1) Communications Specialist @ $40.27/hr x 1.9 hr/wk x 130 wk	$10,158	
TOTAL PERSONNEL	*$157,114*	*$53,527*
Fringe Benefits		
32.43% of salary		
TOTAL FRINGE BENEFITS	*$50,952*	*$17,359*
Travel		
Airfare for 3 trips for conference attendee/s (one or more conferences)	$1,550	
2 nights for 3 conference/s	$1,500	
2 days per diem for 3 conference/s	$450	
TOTAL TRAVEL	*$3,500*	*$0*
Equipment		
VOC Sampler (x5)	$8,500	
Aldehyde Sampler (x5)	$44,370	
TOTAL EQUIPMENT	*$52,870*	*$0*
Supplies		
Sites operational hardware (extension cords, probes, brackets, etc)	$2,000	
Printed materials for community outreach	$1,000	
TOTAL SUPPLIES	*$3,000*	*$0*
Construction		
TOTAL CONSTRUCTION	*$0*	*$0*
Contractual		
VOC Canister analysis (5 sites 7 VOCs)	$125,400	
Aldehyde analysis (5 sites, formaldehyde and acetaldehyde)	$39,780	
PAH analysis (1 site all PAHs)	$38,922	
PM_{10} metals analysis (2 sites all metals)	$51,012	
Community sampling (20 samples, PM_{10} metals or VOCs)	$7,600	
TOTAL CONTRACTUAL	*$262,714*	*$0*
Other		
TOTAL OTHER	*$0*	*$0*
Indirect Charges		
61.37% projected Federal Negotiated Indirect Cost Rate (based on FY15)		
TOTAL INDIRECT	$127,690	$43,503
TOTAL FUNDING	(fed) $657,840	(non-fed) $114,389
TOTAL PROJECT COST (federal and non-federal)		**$772,229**

VOLUNTARY COST SHARE AND LEVERAGED FUNDS

We are committed to a legally obligated cost-share of $114,389 as described in Table 3 and Form SF-424A in this application package. We will pay this amount from our per capita tax and state core grant; no federal funds will be used.

We will also leverage additional resources not included in the itemized cost-share in this application, including fuel and vehicle use for transportation to the sites, site lease and maintenance costs, all of the instruments from Table 1 that are italicized for collocating with air toxics samplers, and particle counters (Dylos and Purple Air) for community sampling. We will also leverage the use of our calibrated flow devices and other maintenance tools, equipment, and accessories for the project. In addition, the Washington State Department of Ecology has agreed to let us leverage the instruments at their Tacoma S 36th St, Seattle 10th and Weller, and Seattle Beacon Hill monitoring sites if awarded this grant.

EXPENDITURE OF AWARDED GRANT FUNDS

We will continue to follow our strict purchasing, contract, and grant policies to ensure we meet EPA and local government requirements. We will select an air toxics testing lab through a competitive process. We will setup a contract with the lab and build in specific timelines and fixed costs throughout the project period.

Internally, we will continue to have project team meetings to ensure we are meeting milestones and deadlines on schedule. We will follow the timeline in Table 2 and ensure we meet the three-year timeline to complete the project from notice of being awarded the grant.

7. COMMUNITY BENEFIT, ENGAGEMENT, AND PARTNERSHIPS

Our Agency prioritizes a few key regions called focus communities, which are geographic locations with degraded air quality and whose residents face economic or historic barriers to participation in clean air decisions and solutions. Our agency's environmental justice map, the Community Air Tool, helps us quantify impacts, where air quality, health, and socio-economic factors overlap.[7,10]

The three focus communities nearest to the sampling sites for this study are shown in Figure 3. Table 4 also quantifies the underrepresented minorities and some of the socioeconomic barriers in these areas.

The Duwamish Valley focus community includes the neighborhoods of Tukwila-Allentown, Seattle Georgetown and South Park, all rooted in industrial settings. The community is bounded by railyards, a major airport (Boeing Field), industrial sources, and major roadways. The area includes a Superfund site, which has had a century of industrial pollution and studies have shown substantial deposition into the ground water and soils of PCBs and metals, including substantial buildup in the Duwamish Waterway. We have partnered with this community over the years in many ways.[11]

Seattle's Chinatown-International District focus community has been a vital centerpiece of Seattle's Asian American community, with a rich multiethnic neighborhood of Chinese, Japanese, Vietnamese, Filipino and other origins. Bounded by Interstate 90 to the South and cut by Interstate 5, they are exposed to the highest traffic volumes of the Pacific Northwest.[12] The Community Air Tool ranks this community in the top 1% most disproportionately impacted areas in our jurisdiction.

The Lakewood focus community and the larger, adjacent Tacoma-Pierce County $PM_{2.5}$ maintenance area for the 2006 standard is intersected by Interstate 5, several state highways, a large industry footprint, and a major air-force military base. Lakewood is the Agency's newest focus community, joining the program in 2019.

Table 4. Summary of the Community Air Tool score (higher is more impacted) and select factors illustrating the some of the disparities for the three areas compared with the rest of the Puget Sound region.

Categories	Seattle Duwamish Valley	Seattle Chinatown-International District	Tacoma-Pierce Maintenance Area[a]	Puget Sound
CAT score	**29.6**	**32.3**	**27**	**18.8**
No high-school degree	26%	35%	11%	8.5
Minority race	56%	75%	32%	28%
Median income	$43,400	$16,700	$56,100	$71,500
Percent limited English	21%	40%	4%	5%
Cardiac Rate (per million per yr)	10,600	25,000	11,100	8,900
Asthma Rate (per million per yr)	950	1290	680	490

[a] Includes Lakewood focus community

The study will bolster our longstanding relationships with community groups in several of these areas and provide opportunities to forge and strengthen new relationships in others. It will also leverage our expertise in community-driven monitoring developed through our 2016-2018 EPA-funded Near-Road Air Toxics Study in the Chinatown-International District (CID Air Toxics Study).[3] Engaging with community members throughout all phases of this study will provide us with a forum to have meaningful dialogue about air quality and how it affects residents' day-to-day lives.

Our community benefit, engagement, and partnerships plan consists of two main components: 1) community outreach and involvement in selecting community monitoring sites, and 2) community updates and dissemination of results.

1) For the community outreach and involvement component, we will leverage our existing relationships with key stakeholders in the focus communities described above to assemble community coalitions to aid in study design. Table 5 contains an initial list of key stakeholders by sampling site and focus community.

Table 5. Key stakeholder organizations

Focus Community	Nearest Sampling Site	Key Stakeholder Organization(s)
Chinatown-International District	Seattle 10th & Weller	InterIm CDA; Seattle Chinatown-International District Preservation & Development Authority
Duwamish Valley	Seattle Duwamish Valley	Duwamish River Cleanup Coalition; Just Health Action
Lakewood	Tacoma South L	Clover Park School District; Tacoma-Pierce County Health Dept.

With the help of key stakeholders, we will facilitate a community-driven monitoring site selection process, which will include providing information on local air quality, health impacts, key emissions sources, and monitoring capabilities. We will rely on our key stakeholders to identify the most appropriate formats and venues for engaging with community members. Following a multilingual, multi-format process for gathering community input, similar to the CID Air Toxics Study,[3] we will identify a total of three community-directed targeted monitoring sites in the Duwamish Valley, in areas of greatest community interest. In addition, we will conduct outreach and educational $PM_{2.5}$ sensor sampling in the Chinatown-International District and Lakewood focus communities.

2) For the second component of our community benefit, engagement, and partnerships plan, we will provide quarterly project updates by email to all key stakeholder organizations and any other interested community groups, and will meet at least twice a year with key stakeholders to provide updates in person, answer questions, and receive feedback. We will also work with key stakeholders to explore opportunities to disseminate project updates more broadly, such as distributing them via community newsletters, newspapers, or bulletin boards.

The community benefit, engagement, and partnerships plan is intended to stimulate discussion within each community about air pollution issues, empower communities to advocate for their air quality, and provide them tools to make evidence-based health decisions. This plan has been informed by previous Community-Scale Air Toxics Ambient Monitoring projects, including our own, and we intend to share the results of this community engagement effort with other local, regional, tribal, state, and national partners to inform their future efforts. We intend to present our findings in a variety of venues, including NW-AIRQUEST, the National Association of Clean Air Agencies, and a national air quality conference. We also intend to offer a webinar for EPA and local, regional, state, and tribal air officials and researchers on the results and outcomes of the community engagement elements of this project.

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